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Dear Tom,

Thank you for the opportunity to review the report entitled "Lower Snake River Temperature and Biological Productivity Modeling" prepared by Normandeau Associates. Following are my comments.

5.3 WQRRS

It would be helpful to have references describing the applications of WQRRS. I am familiar with some of the applications of WQRRS and was involved in some of its development stages. It is true that it is a comprehensive water quality modeling system that has been extensively evaluated and applied. However, as a part of my own work on temperature models of the Snake and Columbia Rivers, I have performed tests on a number of models including WQRRS. These tests were designed to evaluate the ability of various numerical schemes to propagate frequencies of phenomena with a period of a few days or less. The tests showed that for rivers in which advection dominates, WQRRS has relatively poor frequency response characteristics compared to Lagrangian methods and second-order explicit schemes. Advection plays an extremely important role in the heat budget of the Lower Snake River and these frequencies may not be faithfully produced with the numerical scheme used by WQRRS. A number of important conclusions in the report depend on the ability of the model to reproduce phenomena with periods of a few days or less. These conclusions would be strengthened by results of tests demonstrating the model was able to accurately propagate high frequencies in the Lower Snake River.

5.4 APPLICATION OF WQRRS TO THE SNAKE RIVER

WQRRS is a sophisticated, complex model. Normandeau Associates application of WQRRS to the Lower Snake River could be characterized as a comprehensive analysis, was it not for the fact that there is, in essence, no mention of the dominant feature of the ecosystem, the salmon and steelhead that are on the verge of extinction. I found one specific reference in this section to "salmonid species (page 10). In addition, there is the statement on page 14, which I assume is related to salmon and steelhead, that "Several migratory species of fish grow within the system,

leave and grow outside the system for a period of time -----." After reading this section, I had the impression the contractor viewed the Lower Snake River as a place for growing smallmouth bass, northern pikeminnow and channel catfish. This conceptual model is fatally flawed, in my opinion, particularly in light of the considerable research done by the University of Washington, National Marine Fisheries Services, the USGS and others. The report does not even reference the Columbia River Salmon Passage Model (CRiSP.1.5), a model which has an extensive analysis of bioenergetics of the Snake and Columbia aquatic ecosystems. For that matter, the report does not reference much at all, reinforcing the notion that contractors' knowledge of the system is superficial.

The approach used by the consultant for demonstrating the acceptability of the model results appears to be based on the traditional approach in which the model is "Calibrated" and then "Verified." While I recognize that these terms are a part of the accepted modeling approach, I am not convinced they describe the process very well. I find it difficult to believe that a model is "verified" or even "confirmed" by a qualitative comparison of simulated results with one year of actual data of unknown quality. I would feel more comfortable, however, if the contractor made an effort to define these terms and provide a description of what they really mean by the terms, "calibration," "verification" and "confirmation."

The effort to demonstrate that the model simulates natural conditions by comparing results with the 1956 data is a worthy one. It strikes me as a little presumptuous to conclude the model is "verified" by comparing simulated and observed (Central Ferry) when the input to the simulation is the observed. When travel times are short, as they are in the natural river, the input and output could well be very similar. The fact the model does not do as well at the station farther downstream (Sacajawea) suggests the model may not be as accurate as the Central Ferry show, although I have some questions about the validity of the data at Sacajawea.

One page 41, it would help to define the solar radiation turbidity factor and the method used to estimate the bed conduction term(s).

5.5 MODEL PREDICTIONS AND COMPARISON WITH EXISTING CONDITIONS

Since the contractor is using the traditional "calibration/verification" approach, it makes sense, in my view, to compare simulated results with existing conditions as well as with natural river conditions in Figures 5.5-1 through 5.5-12.

One page 76, check the usage of the word "misinterpretating".

Although I question the accuracy of WQRRS for simulating high frequencies and do not find a quantitative discussion of model uncertainty for both normative and existing conditions, I would interpret the results of the analysis somewhat differently than does the contractor. With respect to the temperature simulations, I would conclude there is something peculiar about the 1994 results that cannot be explained by the difference between normative and existing river conditions. The normative (predicted) temperatures are going up, while the existing temperatures are going down. I doubt that is related to the difference in geometry and hydraulics

and that's why it is important to have the simulations for the existing conditions presented on the same graph. For the comparison with 1995 existing data, I would agree that the maxima are of the same order of magnitude (certainly within the accuracy of the measurements and simulations) but that the average exceedance magnitude and frequency are greater for the existing conditions than for the normative. This is similar to the results I obtained with long-term simulations of water temperature in the Snake and Columbia Rivers. In 1997, average magnitude and exceedance appear to be about the same. The excursion of the normative river at Day 243 is matched approximately by the excursion of the existing river around Day 220. This analysis represents only three realizations, however, without an assessment of the uncertainty in the estimates. In light of the uncertainty associated with both simulated and observed results, it is more useful to characterize the uncertainty of the state estimates and to examine as long a record as possible. This is the approach I used in my evaluation of water temperature in the Snake and Columbia Rivers.

For the biologic productivity model, the only conclusion I find credible is: 3) "The biologic productivity model cannot be used in a strict predictive application due to the lack of biologic calibration data for the normative system." In the absence of an analysis of salmon and steelhead, I would go one step further and say the biologic model should not be used for the Lower Snake River until all major components of the ecosystem are included..

Please feel free to contact me at (206) 553-1532 or e-mail: yearsley.john@epa.gov, if you have questions regarding these comments.

                            Sincerely,

                            John Yearsley
                            Environmental Scientist